SUBJECT INDEX

Activation

A ABC transporters	cytokinin perception and signal transduction,	of grasses and cereals, 307-24
iron transport and signaling	616–17	history of research, 1-20
in plants, 195	cytoskeleton remodeling	Agrobacterium tumefaciens
Abies spp.	for growth and form, 691,	cytokinin perception and
photosynthesis of	699-700	signal transduction, 620
overwintering evergreens	Adaptive response	AHA2 gene
and, 330	chloroplast movement and,	iron transport and signaling
abi mutant	465	in plants, 187
protein phosphatases and,	plant peroxiredoxins and,	AHK histidine kinases
74–75	93-103	cytokinin perception and
ABP1 gene	ADF/cofilin	signal transduction, 605,
transfer cells and, 435	cytoskeleton remodeling	609-11, 615, 618
Abscisic acid (ABA)	for growth and form, 706	AhpC gene
history of research, 8, 13	adhl gene	plant peroxiredoxins and,
nitric oxide and, 122-24,	linkage disequilibrium and,	94
127	366	AJH1/2 protein
Absorbed light	Adiantum capillus-veneris	COP9 signalosome and,
photosynthesis of	chloroplast movement and,	167
overwintering evergreens	456-64, 466	alk mutant
and, 329-48	cryptochrome structure and	starch biosynthesis and,
Accumulation movements	signal transduction,	218
chloroplast movement and,	474-76, 479	Allelic association
456-61, 464	ADPglucose	linkage disequilibrium and,
Aceptabularia mediterranea	pyrophosphorylase	357-71
chloroplast movement and,	starch biosynthesis and,	Allelic series
465	212-13	single-nucleotide reverse
Acer spp.	Adventitious embryony	genetics and, 375,
phospholipid-based	apomixis and, 554	392-94
signaling and, 291	Aequorin	Alnus rubra
plant cell cycle and, 238	cryptochrome structure and	transfer cells and, 443
acsF gene	signal transduction, 483	Alternative oxidase (AOX)
diiron carboxylate proteins	Affinity enhancement model	diiron carboxylate proteins
and, 507-8	disease resistance genes	and, 497, 501-4
Actin	and, 39	Amaranthus spp.
chloroplast movement and,	AFT1 gene	nitric oxide and, 125
456, 463-64	iron transport and signaling	Amyema miquellii
cytoskeleton remodeling	in plants, 186, 196	photosynthesis of
for growth and form, 691,	Agriculture	overwintering evergreens
702, 704-12	apomixis and, 547-67	and, 341
A .* .*	25.5	A 1

gibberellins and flowering

Amylopectin

starch biosynthesis and, 207-8, 216, 224

Amylose

starch biosynthesis and, 207-8, 214-19

anl gene

gibberellins and flowering of grasses and cereals, 324

Anabaena sp.

diiron carboxylate proteins and, 509

Anacystis nidulans

cryptochrome structure and signal transduction, 471

angustifolia mutant

cytoskeleton remodeling for growth and form, 709-10

Antenna protonation photosynthesis of overwintering evergreens and, 329, 342-44

Antioxidant defense nitric oxide and, 114–15 plant peroxiredoxins and, 93, 101–3

Antirrhinum spp.

gibberellins and flowering of grasses and cereals, 319 plant cell cycle and, 242,

248 AP genes

COP9 signalosome and, 174

gibberellins and flowering of grasses and cereals, 315

Apomixis

adventitious embryony, 554 apomixis-specific factors, 565-66

apospory, 554, 557–58 autonomous embryo component, 558–59

cell fate, 557-58

conclusions, 566–67 development, 548–53, 562–63

diplospory, 554, 557–58 double fertilization, 552 embryo initiation control.

552

endosperm, 552-53, 559-63

epigenetic gene regulation, 564-65

female gametophyte, 550 FIS genes, 552-59

fruit development, 548–53 gamethophytic apomyxis, 554

genetic control, 555 hybridization, 563

initiation, 551, 553-54 introduction, 548

LI layer, 553-54

LII layer, 550, 553-54 mechanisms, 553-63

mixed allsorts, 554-55

mutation, 563-64

nucellar tissue, 550 ovule development,

548-53

pattern formation, 550–51 seed development, 548–53 sexual plants, 551

sexual reproduction, 555-57, 559-62

somatic embryogenesis, 558–59

uncoupling, 551

updated models for control, 563–66

Apo-symplastic solute exchange

transfer cells and, 431-48

APRR genes

cytokinin perception and signal transduction, 614 Arabidopsis thaliana

apomixis and, 550-51, 553, 556, 558-62, 564

brassinosteroids and, 137–51, 155 chloroplast movement and,

456–61, 463–65

COP9 signalosome and, 165-78

cryptochrome structure and signal transduction, 469, 472–89

cytokinin perception and signal transduction, 605, 607, 609, 611–14, 617–20

cytoskeleton remodeling for growth and form, 693, 705-8, 711-12

diiron carboxylate proteins and, 502-3, 505, 507, 509 disease resistance genes

and, 25–27, 31, 33, 41, 43, 45, 47–49

epidermal patterning and, 403-24

functional genomics of P450s and, 631, 633–34, 636–52, 654–56

gibberellins and flowering of grasses and cereals, 315, 318-20, 324

history of research, 6–7 iron transport and signaling in plants, 187–90, 192–93, 195–97, 199–200

K⁺ transport in higher plants and, 579–80, 582, 584–85, 587–90, 592, 594

lignin biosynthesis and, 525, 529–33, 536 linkage disequilibrium and,

357, 362–67, 369–70 metabolomics in systems

metabolomics in systems biology and, 671, 675, 682–83

nitric oxide and, 125 phospholipid-based signaling and, 269–80, 282–91

and, 329-48

plant cell cycle and, 235, component plant peroxiredoxins and, 237-38, 240-51, 254 apomixis and, 558-59 94.96 plant peroxiredoxins and, starch biosynthesis and, Auxins 94-95, 99-101 COP9 signalosome and, 207-27 protein phosphatases and, 165, 170, 172-73 BASI gene 63-83 history of research, 4, 13 brassinosteroids and, single-nucleotide reverse iron transport and signaling 154-55 genetics and, 376. in plants, 200 Basic helix-loop-helix 378-82, 386, 389-90, nitric oxide and, 121-22 (bHLH) 393-97 Avirulence proteins epidermal patterning in starch biosynthesis and, disease resistance genes Arabidopsis and, 403, and. 28 213-16, 218-19, 222, 416-17 225-26 Avoidance movements Berberis spp. transfer cells and, 432, chloroplast movement and. functional genomics of 442-43, 445-46, 448 456-59, 461, 464 P450s and, 652 Arabis holboellii Axial growth Betacyanin apomixis and, 562 cytoskeleton remodeling nitric oxide and, 125 ARN gene for growth and form, Beta vulgaris iron transport and signaling 691 linkage disequilibrium and, in plants, 186 axrl mutant 363 ARP2/3 complexes COP9 signalosome and, BETLI-4 genes cytoskeleton remodeling transfer cells and, 447 for growth and form, Betula pubescens 704-5 B photosynthesis of ARR genes Bacillus megaterium overwintering evergreens cytokinin perception and functional genomics of and, 330 signal transduction, 605, P450s and, 632 612-16 **Background mutations** linkage disequilibrium and, Asexuality single-nucleotide reverse 363-64 apomixis and, 547-67 genetics and, 389-91 Biotechnology Bacteria lignin biosynthesis and, ASKI gene COP9 signalosome and, chloroplast movement and, 519, 535-36 174 460 Blue light Association mapping cryptochrome structure and chloroplast movement and, linkage disequilibrium and, signal transduction, 471, 456-61 357-71 473-76 cryptochrome structure and Asterias rubens cytokinin perception and signal transduction, 469, nitric oxide and, 116 signal transduction, 609, 481-83, 487-89 Atriplex spp. 616, 620 Blumeria graminis transfer cells and, 442 diiron carboxylate proteins disease resistance genes and, 502, 505-7 ATX1 gene and, 25-26, 43 iron transport and signaling disease resistance genes BNST3 gene in plants, 186, 195 and, 23-49 brassinosteroids and, 155 A-type cyclins functional genomics of Boreal forests plant cell cycle and. P450s and, 632, 652-54 photosynthesis of 243-44 K+ transport in higher overwintering evergreens

plants and, 583

Autonomous embryo

Bos taurus	dwf3, 143	genes, 155
linkage disequilibrium and,	dwf4, 143	related mutants, 155
365	dwf5, 149	steroid sulfotransferases,
Bottlenecks	dwf6, 142	155
transfer cells and, 431-48	dwf7, 149	Bremia lactucae
8-Br-cGMP	early and late C-6	disease resistance genes
nitric oxide and, 122	oxidation pathways,	and, 25
BR6ox gene	139-41	Bridge model
brassinosteroids and,	early C-22 oxidation	disease resistance genes
143-44	branch, 141	and, 38
Brachiaria spp.	ell, 149	brittle-2 mutant
apomixis and, 554, 558	enzymes, 141-44, 148	starch biosynthesis and,
Brachythecium velutinum	24-epiCS conversion to	212
transfer cells and, 434	24-epiBL, 144	BRK1 gene
Branching enzymes	fackel, 149	cytoskeleton remodeling
starch biosynthesis and,	feedback regulation, 145	for growth and form,
207, 219-22	genes, 141-44, 148	709
Brassica spp.	hyd1, 149	Bromis inermis
brassinosteroids and, 151,	hyd2, 149	gibberellins and flowering
155	2-hydroxylase, 144	of grasses and cereals,
phospholipid-based	le, 149	320
signaling and, 280	light, 145-46	bronzel gene
plant peroxiredoxins and,	lk, 143	linkage disequilibrium and,
96	lkb, 150	370
protein phosphatases and,	OsDwarf, 144	Bryum capillare
68	refined pathway from	transfer cells and, 434
Brassinosteroids (BRs)	campesterol to	brz mutant
biosynthesis	campestanol, 141	iron transport and signaling
AtCYP51, 148	regulation, 145–46	in plants, 198–99
biosynthesis inhibitors,	related mutants, 141–44,	B-type cyclins
146	148	plant cell cycle and,
brd1, 144	reversible conversion,	244-46
	144	
bull, 149		bull mutant
cbb1, 150	sax1, 142	brassinosteroids and, 149
cbb3, 143	smt1, 148	Bundling
cpd, 143	smt2, 148	cytoskeleton remodeling
cph, 148	stel, 149	for growth and form,
cro1, 142	sterols, 146-50	706–7
cro2, 150	teasterone, 144	6
cro3, 143	typhasterol, 144	C
cro6, 149	C ₂₇ BRs, 141	C2-domain
cvp1, 148	conclusions, 155-56	phospholipid-based
det2, 142	introduction, 138	signaling and, 271
dim, 150	metabolism, 150-55	C-6 oxidation
dpy, 143	BAS1, 155	brassinosteroids and, 137,
Dwarf, 143-44	CYP72B1, 155	41
dwf1, 150	enzymes, 155	C-22 oxidation

signal transduction, of grasses and cereals, 620-21 141 Ca2+ 313-14 epidermal patterning in Catalytic center Arabidopsis and, 411-12, chloroplast movement and, 461-63 plant peroxiredoxins and, 415-16, 421 cytoskeleton remodeling 93-103 K+ transport in higher for growth and form, 691, Catharanthus roseus plants and, 594 698-700 brassinosteroids and. plant K+ transport in higher 137-39, 141, 150 A-type cyclins, 243-44 plants and, 590-91 functional genomics of B-type cyclins, 244-46 P450s and, 654 **cADPR** CDK-activating kinases, nitric oxide and, 122-24 phospholipid-based 242 - 43Caenorhabditis elegans signaling and, 283 CKS, 250 cytokinin perception and plant cell cycle and, 238, conclusions, 255 signal transduction, control, 238-41 Cation chloride cotransporter 607 core regulators, 241-251 diiron carboxylate proteins (CCC) family cyclin-dependent kinase and, 506-7 K+ transport in higher inhibitors, 249-50 disease resistance genes plants and, 586 cyclin-dependent and, 45 Cation proton antiporter kinases, 241-42 epidermal patterning in (CPA) family cyclins, 243-49 Arabidopsis and, 424 K+ transport in higher D-type cyclins, 246-49 functional genomics of plants and, 586 E2F, 251 P450s and, 633 ch-2 mutant endoreduplication, protein phosphatases and, brassinosteroids and, 143 253-54 74 G₁/S transition, 251-52 cbb mutants caklAt gene brassinosteroids and, 143, G2/M transition. plant cell cycle and, 252-253 243 hormones, 254, 255 CCC genes Calmodulin iron transport and signaling H-type cyclins, 249 nitric oxide and, 125 in plants, 186, 195 introduction, 236 Campestanol CCH gene landmarks, 236-37 brassinosteroids and, 141 mitosis, 252-53 iron transport and signaling in plants, 195 Campesterol progression, 251-54 brassinosteroids and, 141, CC motif retinoblastoma protein, 146 disease resistance genes 250 and, 31 synchronous cell Capsicum annuum photosynthesis of cdc mutants systems, 237-38 overwintering evergreens plant cell cycle and, 238, transitions, 251-54 and, 345 transfer cells and, 431-48 Carotenoids protein phosphatases and, Cell fate diiron carboxylate proteins apomixis and, 557-58 and, 497-511 CDK-activating kinases epidermal patterning in nitric oxide and, 126 plant cell cycle and, Arabidopsis and, 406-8, Catabolism 242-43 413-14, 421-24 functional genomics of Cell cycle Cellulose microfibrils P450s and, 629, 635 cytokinin perception and transfer cells and, 438

gibberellins and flowering

brassinosteroids and, 137,

Cell wall

cytoskeleton remodeling for growth and form, 691,

transfer cells and, 431-48

Cenchrus ciliarus

apomixis and, 565

Cereals

gibberellins and flowering of grasses and cereals, 307-24

Chelation

iron transport and signaling in plants, 183, 190-91

Chemical messengers nitric oxide and, 109-28

Chemical mutagenesis single-nucleotide reverse genetics and, 375-98

Chenopodium rubrum phospholipid-based signaling and, 280

Chlamydomonas reinhardtii cryptochrome structure and signal transduction, 476 cytokinin perception and signal transduction, 614 diiron carboxylate proteins

and, 505, 507-10 phospholipid-based signaling and, 268. 272-74, 278, 283-84,

286-87, 291 plant peroxiredoxins and, 99-100

starch biosynthesis and, 213-18, 222-23, 225-27

chln mutant

iron transport and signaling in plants, 199

2-Chloroethyl

trimethylammonium chloride

gibberellins and flowering of grasses and cereals, 323

Chlorophyll

diiron carboxylate proteins and, 497-511

Chloroplasts

movement

calcium ions, 461-63 cytoskeleton, 463-64 downstream from photoreceptors, 461-64 ecological significance, 464-66

perspectives, 466 photoreceptors, 457-64

phototropins, 457-61 phytochromes, 460-61

plant peroxiredoxins and, 93-103

Chlororespiration

diiron carboxylate proteins and, 497-511 photosynthesis of overwintering evergreens and, 329-48

Cholesterol

brassinosteroids and, 146

Chromatin

cryptochrome structure and signal transduction, 469, 480

Chromophore-binding domain

cryptochrome structure and signal transduction, 469, 474-75

CHS gene

cryptochrome structure and signal transduction, 482-83

Circadian clock

cryptochrome structure and signal transduction, 469, 483-84

ckil mutant

cytokinin perception and signal transduction, 608-9

CKS proteins plant cell cycle and, 250

Cladosporium fulvum

disease resistance genes and, 25, 28, 36, 41

phospholipid-based signaling and, 279

clk1 mutant

diiron carboxylate proteins and, 506

Clock proteins

cryptochrome structure and signal transduction, 469

Cloning

K+ transport in higher plants and, 576-77 lignin biosynthesis and, 519 phospholipid-based signaling and, 277, 282,

285, 288-90 clv1 mutant

protein phosphatases and, 75

CMT3 gene

single-nucleotide reverse genetics and, 397

Cochliobolus carbonum disease resistance genes and, 26

Cofilin

cytoskeleton remodeling for growth and form, 706

Cold acclimation photosynthesis of overwintering evergreens and, 329-48

Cold stress

functional genomics of P450s and, 642, 644

Compartmentalization iron transport and signaling in plants, 194-96

Conifers

photosynthesis of overwintering evergreens and, 329-48

Conjugation

brassinosteroids and, 137, 155

Conserved regulatory module epidermal patterning in Arabidopsis and, 416-17 COP1 protein cryptochrome structure and signal transduction, 469, 481, 485-89 COP9 signalosome architecture, 167-69 auxins, 172-73 biochemical activity, 175 conclusions, 177-78 COP1, 171-72 COP10, 171-72 cop/det/fus mutants. 166-67 de-neddylation, 175-76 development, 169-70, 172-75 discovery, 166-67 disease resistance, 174-75 E3 ligases, 176-77 flower development, 174 introduction, 166 jasmonic acid, 173-74

> photomorphogenesis, 169-72 repression, 171-72 RUB1/NEDD8, 175-76 SCF ubiquitin ligases, 172-75

lid subcomplex of

proteasome, 168-69

MPN motifs, 168-69 PCI motifs, 168-69

subcellular localization, 176 subunit composition, 167–68

ubiquitin-proteasomemediated protein degradation, 170-71

Coq7 gene diiron carboxylate proteins and, 506-7 cpd mutant

brassinosteroids and, 143

cph mutant brassinosteroids and, 148

Crassulacean acid metabolomics in systems biology and, 676-77, 679

Craterostigma spp. phospholipid-based signaling and, 286

Crd1 gene diiron carboxylate proteins and, 507-9 CREL/WOL/AHK4 histidine

kinase cytokinin perception and signal transduction, 605, 609–11, 615, 618

cro mutants brassinosteroids and, 142-43, 149-50

Crop plants apomixis and, 547–67 gibberellins and flowering of grasses and cereals, 307–24 history of research, 1, 3–4, 10–18, 20

Cross-talk nitric oxide and, 121-26

CRY gene chloroplast movement and, 462

cryptochrome structure and signal transduction, 469, 473–76, 478–80, 482–89 Cryptochromes

structure and signal transduction chromatin interaction, 480 circadian clock, 483–84 conclusions, 489 COP1, 485–86

> cryptochromeinteracting proteins, 484–87

C-terminal extensions,

DAS domain, 477 de-etiolation, 481-83 degradation, 480 DNA photolyases, 471 evolution, 472-73 introduction, 470-71 nuclear localization. 479-80 nuclear speckles, 487 perspectives, 489 phosphorylation, 487-89 photolyase cryptochrome gene family, 471-77 photoperiodic flowering, 483-84 phytochromes, 486 plant cryptochromes, 473-80 signal transduction, 481-89 structure, 470-80 structure-function relationships, 477-80 ZTL/LKP1/ADO1, 486-87

Cryptomeria japonica brassinosteroids and, 151 csn mutants COP9 signalosome and,

170
CtBP/BARs-like protein
cytoskeleton remodeling
for growth and form,
709-10

C-terminal extensions cryptochrome structure and signal transduction, 477

Cth1 gene diiron carboxylate proteins and, 507-9

Cucumis sativus brassinosteroids and, 151 Cucurbita maxima

iron transport and signaling in plants, 194 Cunninghamella echinulata 730 SUBJECT INDEX brassinosteroids and, 151, 154 Cuscuta reflexa photosynthesis of overwintering evergreens and, 341 cvp1 mutant brassinosteroids and, 148 Cvanobacteria starch biosynthesis and, 207-27 CYC genes plant cell cycle and, 244-55 Cyclase-associated protein cytoskeleton remodeling for growth and form, 705-6 Cyclic nucleotide-gated channels K+ transport in higher plants and, 585 Cyclic nucleotides K+ transport in higher plants and, 590-91

Cyclin-dependent kinase complexes plant cell cycle and, 235, 241-42

Cyclin-dependent kinase inhibitors plant cell cycle and, 249-50 Cyclins

plant cell cycle and, 235, 243-49

Cycloartenol brassinosteroids and, 146-47 Cynodocea nodosa

K⁺ transport in higher plants and, 580 Cynosurus cristatus

Cynosurus cristatus history of research, 9-10 CYP genes

brassinosteroids and, 155 functional genomics of

P450s and, 629, 632-34, 639, 645-47, 651 Cysteinyl residue plant peroxiredoxins and, 93-103 Cytochrome P450 brassinosteroids and, 137. 144, 146, 155 Cytochrome P450 monooxygenases functional genomics approaches to functional analysis, 635-38 biochemistry, 630-31 EMS mutagenesis, 646-49 expression profiling, 638-44 functional expression, 651-55 functions, 634-35 genomic complexity, 633-34 heterologous systems, 651-54 introduction, 630 microarrays, 638-44 molecular modeling. 654-55 nomenclature, 631-33 oligonucleotide arrays. 638-44

overexpressing

fusions, 645

646-51

645-46

647,650

646-49

Cytokinins

summary, 655

constructs, 650-51

phenotypic analysis,

protein localization,

silencing constructs,

T-DNA/transposon

knockout analysis,

P450 promoter: reporter

whole plants, 619–20
Cytoskeleton
chloroplast movement and,
463–64, 466
remodeling fo.: growth and
form
actin, 702, 709–12
actin-binding proteins,
704–8
activation, 699–700
ADF/cofilin, 706
angustifolia, 709–10
ARP2/3 complexes,
704–5

BRK1, 709

bundling, 706-7

Ca2+, 698-99

history of research, 13

perception and signal

transduction

APRRs, 614

608-12

output, 619

614-15

612-19

role, 619-20

transcriptional

nitric oxide and, 124-27

activation, 616-19

Arabidopsis, 611-14

cell division, 620-21

HPt proteins, 614-15

introduction, 606-7

prokaryotes, 616-17

activation, 616-17

receptors, 608-10

response regulators,

regulators, 615-16

two-component system,

type-A ARRs, 612-16

type-B ARRs, 614-16

phosphotransfer,

plants, 617-20

receiver domain

conclusions, 621

histidine kinases.

Ca2+-permeable channels, 699-700 conclusions, 712-13 CtBP/BARs-like protein, 709-10 cyclase-associated protein, 705-6 depolarization, 699-700 EF-1α, 706-7 emerging trends, 693-96 exocytosis, 701-4 fimbrin, 706-7 form, 696-98 formins, 704-5 future research, 712-13 genome analysis, 694 G proteins, 700-1, 706-9 growth, 701, 708-9 growth continuum. 696-98 heterotrimeric G proteins, 701 highly conserved, single copy genes, 695 hyperpolarization, 699-700 introduction, 692-93 microfilament bundles. 702 - 3microfilament networks, 702 - 8microtubule assembly status, 710-12 microtubule-plasma membrane interactions, 712 microtubule-wall interactions, 712 multigene families of cytosksleton and cytoskeleton-related proteins, 694-95 myosin, 707-8 pathways, 698-701 phosphoinositide signaling, 701

plasma membrane, 698, 703-4 polarized growth, 709 profilins, 704-5 ROP GTPases, 700. 708-9 severing, 706-7 signals, 698-701 SPIKE1, 708-9 switches, 698-701 transient and highly conserved dichotomies within gene families, 695-96 unique nature of cytoskeleton, 696 upstream regulation, 708-9 villin, 706-7

D

d1/d3/d5 mutants
gibberellins and flowering
of grasses and cereals,
324

Datura spp.
apomixis and, 550

Daucus carota
K+ transport in higher
plants and, 579

Daylength
gibberellins and flowering
of grasses and cereals,
307-24

Deazaflavin cryptochrome structure and signal transduction, 471

Debranching enzymes starch biosynthesis and, 207, 222-24

Dedicated enzymes functional genomics of P450s and, 635

De-etiolation cryptochrome structure and signal transduction, 481–83

Defense compounds functional genomics of P450s and, 629, 634-37 Dehydration phospholipid-based signaling and, 286-87 Dehydrogenation lignin biosynthesis and, 519, 532-33 De-neddylation COP9 signalosome and. 175-76 2'-Deoxymugineic acid (DMA) iron transport and signaling in plants, 190-91

Dephosphorylation protein phosphatases and, 63–83
Depolarization

epolarization cytoskeleton remodeling for growth and form, 699-700

Derepression model disease resistance genes and, 39–40 Destruction box

Destruction box plant cell cycle and, 239 det mutants brassinosteroids and, 142

brassinosteroids and, 142 COP9 signalosome and, 167, 171–72 iron transport and signaling

in plants, 141

Development apomixis and, 547–67 COP9 signalosome and, 165–78 epidermal patterning in Arabidopsis and, 403–24 functional genomics of P450s and, 629 K+ transport in higher plants and, 575–94 nitric oxide and, 109 plant peroxiredoxins and, 93–103

transfer cells and, 431-48 174-75 del mutant iron transport and signaling in plants, 198-99 Diacylglycerol pyrophosphate phospholipid-based signaling and, 265. 281-83 Dichanthium annulatum apomixis and, 562 Dicotyledonous plants iron transport and signaling in plants, 187-90 Dictvostelium discoideum protein phosphatases and, 74 Diiron carboxylate proteins membrane-bound alternative oxidase, NBS region, 30-31 501-4 diiron 5-demethoxyquinone pathogen effector proteins, hydoxylase, 506-7 28-40 introduction, 498 membrane-bound diiron carboxylate proteins.

500 - 1Mg-protoporphyrin IX monomethylester hydroxylase, 507-10 overview, 498-500. 510-11 plastid terminal oxidase,

dim mutant brassinosteroids and, 150

Diplospory apomixis and, 554-58 Disease resistance proteins

affinity enhancement model, 39 avirulence proteins, 28 bacterial effectors, 28-29 bridge model, 38

CC motif, 31 classes, 24-27 COP9 signalosome.

derepression model, 39-40 dual recognition model, 40 effectors, 28-40 function, 28-29, 48-49 future perspectives, 48-49 introduction, 24

localization, 36 LRR domain, 30

matchmaker model, 38-39 miscellaneous motifs and structures, 32-33

model systems, 27-28 multiple recognition specificities, 33

multiprotein recognition complexes, 33-35

new experimental approaches, 48-49

phosphorylation, 46-47

protein degradation, 45-46 receptor-ligand model, 38 recognition complexes,

33-40

R gene-mediated signaling. 40-45

R proteins, 36-48 signal transduction, 40-48 STK domain, 32 structural motifs, 29-33 TIR domain, 31

virulence proteins, 28 Dithiothreitol (DTT) plant peroxiredoxins and,

DNA photolyase cryptochrome structure and signal transduction, 469. 471-77, 479

Double fertilization apomixis and, 552

Downstream regulation functional genomics of

P450s and, 629 phospholipid-based signaling and, 265 dpy mutant

brassinosteroids and, 143

DOXVP-acidic-STAES (DAS) domain cryptochrome structure and signal transduction, 469, 474-75, 477, 479

Drosophila melanogaster COP9 signalosome and, 168

cryptochrome structure and signal transduction, 472 cytokinin perception and signal transduction, 607 disease resistance genes

and, 45 functional genomics of P450s and, 633

linkage disequilibrium and, 364-65, 367

nitric oxide and, 116 single-nucleotide reverse genetics and, 382, 386

Drought stress functional genomics of P450s and, 642

Dryopteris sparsa chloroplast movement and,

D-type cyclins plant cell cycle and, 246-49

dul mutant starch biosynthesis and, 218

Dual recognition model disease resistance genes and, 40

Duchenea indica transfer cells and, 443 Dunaliella salina

phospholipid-based signaling and, 291

Dwarf gene

P450s and, 646-49

transfer cells and, 447

plant cell cycle and,

apomixis and, 547-67

END-1 gene

Endoreduplication

Energy conundrum

and, 331

320 - 23

epc mutant

324

93, 99-100

Epidermal patterning

Arabidopsis and

421-22

421-24

cell cycle, 411-12,

module, 416-17

environmental

epidermis, 405

411, 415

415-16, 421

nitric oxide and, 109

photosynthesis of

Environmental factors

253-54

Endosperm

brassinosteroids and. 143-44 linkage disequilibrium and, 363, 368 Dwarfism brassinosteroids and. 137-38 dwf mutants brassinosteroids and, 142-43, 149-50, 156 Dynamic networks metabolomics in systems biology and, 669-84 E2F transcription factor plant cell cycle and, 251 E3 ligases COP9 signalosome and, 172, 174-77 Echinocloa utilis transfer cells and, 434 Ecology chloroplast movement and, 456, 464-66 EDI locus cryptochrome structure and signal transduction, 484 EF-1α protein cytoskeleton remodeling for growth and form, 706-7 Effector proteins disease resistance genes and, 23-49 EIN2 gene iron transport and signaling in plants, 189 Electron transport photosynthesis of overwintering evergreens and, 329, 341-42 Embryo sac apomixis and, 547-67 EMS mutagenesis

chloroplast movement and,

458

functional genomics of introduction, 404-5 leaf development. 421-22 local signaling, 408-10, 414-15, 418-20 MYB proteins, 416-17 pavement cells, 421-22 prepattern signaling, 415 root hairs, 412-16. 422-23 stomata, 417-22 overwintering evergreens tissue specificity, 411-21 transdetermination. 410-11 epidermal patterning in trichomes, 405-12, 416, Arabidopsis and, 420-21 421-22 functional genomics of **Epigenesis** P450s and, 629, 642-43 apomixis and, 564-65 gibberellins and flowering 3-Epihydroxy of grasses and cereals. 2'-deoxymugineic acid (epi-HDMA) iron transport and signaling in plants, 190-91 plant peroxiredoxins and, 3-Epihydroxymugineic acid (epi-HMA) gibberellins and flowering iron transport and signaling of grasses and cereals. in plants, 190-91 **Epimerization** brassinosteroids and, 137. 144, 150, 154-55 bHLH proteins, 416-17 **Epistasis** linkage disequilibrium and, cell differentiation, Erisyphe chicoracearum disease resistance genes cell fate, 406-8, 413-14, and. 26 Escherichia coli conclusions, 423-24 chloroplast movement and, conserved regulatory cryptochrome structure and development, 418-20 signal transduction, 471, 473-76 influences, 420-21 cytokinin perception and signal transduction, 609, hormone regulation, 616 diiron carboxylate proteins hypocotyl, 422-23 and, 502-7

functional genomics of P450s and, 652-54 K⁺ transport in higher plants and, 583 phospholipid-based signaling and, 284 plant peroxiredoxins and, 94, 96 starch biosynthesis and, 207, 209-11, 223

Ethylene

cytokinin perception and signal transduction, 611-12 iron transport and signaling in plants 200

in plants, 200 nitric oxide and, 126 phospholipid-based signaling and, 287

Eucalyptus spp.

K⁺ transport in higher plants and, 580 photosynthesis of overwintering evergreens and, 333, 337, 343

Euonymus kiautschovicus photosynthesis of overwintering evergreens and, 337, 340, 343

Evans L, 1–21 Evolution

COP9 signalosome and, 165

cryptochrome structure and signal transduction, 469, 472–73

cytoskeleton remodeling for growth and form, 695–96

gibberellins and flowering of grasses and cereals, 318-19

photosynthesis of overwintering evergreens and, 329–48 starch biosynthesis and,

207

Exocytosis

cytoskeleton remodeling for growth and form, 691, 701-4

Expression profiling functional genomics of P450s and, 638–44

extreme dwarf mutant brassinosteroids and, 143

F

fackel mutant brassinosteroids and, 148-49, 156

FAS genes plant cell cycle and, 250 Fatty acids

functional genomics of P450s and, 629, 633–34, 636–37, 641, 643

Fe²⁺/Fe³⁺ iron transport and signaling in plants, 183

Feedback regulation brassinosteroids and, 145

Female gamete formation apomixis and, 547-67

FER gene iron transport and signaling in plants, 197

feronia mutant apomixis and, 552

Fertilized soils nitric oxide and, 109,

119-20, 127 FET genes

FET genes

iron transport and signaling in plants, 185–86, 188–89, 192–93

Fimbrin

cytoskeleton remodeling for growth and form, 706-7

FIS genes

apomixis and, 552-53, 559

Floral evocation gibberellins and flowering of grasses and cereals, 307, 311-12

Florigens

gibberellins and flowering of grasses and cereals, 307-24

Flowering

COP9 signalosome and, 165, 174 cryptochrome structure and signal transduction, 469, 483–84 gibberellins and flowering

of grasses and cereals, 307-24

history of research, 1, 3-10, 14, 17, 20

Folate

cryptochrome structure and signal transduction, 471, 474–75, 478

Formins

cytoskeleton remodeling for growth and form, 704-5

14-3-3 proteins

K⁺ transport in higher plants and, 589

Frankia spp. transfer cells and, 443

FRE genes iron transport and signaling in plants, 187, 199–200

FRE genes

iron transport and signaling in plants, 185-86

FRIGIDA gene

linkage disequilibrium and,

FRO genes

iron transport and signaling in plants, 187–88, 193, 196–98, 200

Frost hardening

photosynthesis of overwintering evergreens and, 329, 332–35, 339–41

linkage disequilibrium and,

Fruit development signaling and, 280 Gibberellins (GAs) brassinosteroids and, 146 apomixis and, 548-53 Gametic phase disequilibrium linkage disequilibrium and. flowering of grasses and FTH1 gene iron transport and signaling 357-71 cereals in plants, 186 Gametophytic apomyxis barley, 321 FTR1 gene apomixis and, 554 catabolism, 313-14 iron transport and signaling GAMYB gene cereals, 320-23 in plants, 185-86 gibberellins and flowering environment, 320-23 Fuchsia hybrida of grasses and cereals, evolution, 318-19 gibberellins and flowering 315, 323 floral evocation. of grasses and cereals, Gas chromatography/mass 311-12 323 spectrometry (GC/MS) florigenicity, 315-18 Functional genomics metabolomics in systems grasses, 320 cytochrome P450 biology and, 669-84 inflorescence development, 312-13 monooxygenases and, GeneChip arrays 629-56 functional genomics of introduction, 308 single-nucleotide reverse P450s and, 644 LD-responsive cereals. genetics and, 375-98 Genomics 321 Fungi cytoskeleton remodeling leaves, 310-11 disease resistance genes for growth and form, 691. Lolium temulentum, and, 23-49 694 309-12 transfer cells and, 431-48 disease resistance genes long day, 310-13 Fusarium oxysporum and, 23 molecular events, disease resistance genes functional genomics of 314-15 and, 25 P450s and, 629-56 overview, 323-24 linkage disequilibrium and, Panicoid grasses, 320 FUS genes COP9 signalosome and, 357-71 perennial Pooid grasses, 167 protein phosphatases and, 320 **FYVE** domain regulation, 309 single-nucleotide reverse phospholipid-based rice, 322 signaling and, 269-70 genetics and, 375-98 SD-responsive cereals, Genotyping 321 - 23G apomixis and, 547-67 shoot apex, 311-15 G1/S transition metabolomics in systems sorghum, 322-23 plant cell cycle and, biology and, 671-75 species comparisons, 251-52 single-nucleotide reverse 318-19 structure, 313-18 G₂/M transition genetics and, 389. plant cell cycle and, 391-92 warm-climate cereals, 252-53 Geum montanum 321 - 23GA biosynthesis inhibitors photosynthesis of wheat, 321 brassinosteroids and, 146 overwintering evergreens Zea mays, 321-22 gai mutant and, 346 history of research, 8-9. gibberellins and flowering ghost gene 13-14 of grasses and cereals, diiron carboxylate proteins nitric oxide and, 124-26 324 and, 505 GL1 gene

Gibberellic acid

history of research, 4

Galdieria sulphuraria

phospholipid-based

glg mutants starch biosynthesis and, 209-10

Globodera spp. disease resistance genes and, 25

α-1,4 Glucanotransferases starch biosynthesis and, 224–25

Glutamate receptors K⁺ transport in higher plants and, 585

Glutaredoxins plant peroxiredoxins and, 93-103

Glycine max linkage disequilibrium and, 369

Glycogen starch biosynthesis and, 207, 225-26

Glycogenin starch biosynthesis and, 225-26

Gossypium spp. epidermal patterning in Arabidopsis and, 405 K⁺ transport in higher plants and, 580

G proteins cytoskeleton remodeling for growth and form, 691, 700-1, 706-9

Graminaceous plants iron transport and signaling in plants, 190-92

Grand Rapids process nitric oxide and, 125

Granule-bound starch synthase (GBSSI) starch biosynthesis and, 213-17

Grasses gibberellins and flowering of grasses and cereals, 307-24

Green algae

starch biosynthesis and, 207-27

Growth continuum cytoskeleton remodeling for growth and form, 696–98

Guard sap

K+ transport in l

K⁺ transport in higher plants and, 575–94

GUS gene cytokinin perception and signal transduction, 612

H

Hedera helix
photosynthesis of
overwintering evergrees

overwintering evergreens and, 337 Helianthus annus

nitric oxide and, 118

Heterodera spp.
disease resistance genes
and, 26
transfer cells and, 443

Heteroduplex analysis single-nucleotide reverse genetics and, 383–85

Heterologous systems functional genomics of P450s and, 651-54

Heterotetramerization K⁺ transport in higher plants and, 587-88 Hevea brasiliensis

phospholipid-based signaling and, 289 Hieracium spp.

apomixis and, 554-59, 561, 564 transfer cells and, 444

High-throughput detection single-nucleotide reverse genetics and, 375–98

Histidine kinases cytokinin perception and signal transduction, 605-21 HKT transporters K⁺ transport in higher plants and, 575, 584–85 Homeostasis

iron transport and signaling in plants, 183–201 K+ transport in higher plants and, 575–94

Hordeum vulgare
K+ transport in higher

plants and, 580 transfer cells and, 434 Hormones

COP9 signalosome and, 165, 172-74

cytokinin perception and signal transduction, 605–21 epidermal patterning in

Arabidopsis and, 411, 415 history of research, 4, 13 iron transport and signaling

in plants, 200 nitric oxide and, 109,

121-26 plant cell cycle and, 254-55

HPt proteins cytokinin perception and signal transduction, 614-15

H-type cyclins plant cell cycle and, 249 Hybridization

apomixis and, 563

brassinosteroids and, 148–49

Hydroxylases brassinosteroids and, 144 diiron carboxylate proteins and, 497, 506-7

Hyoscyamus spp. history of research, 6

Hyperosmotic stress phospholipid-based signaling and, 291 Hyperpolarization cytoskeleton remodeling for growth and form, 699-700

Hypocotyl

cryptochrome structure and signal transduction, 481–82 epidermal patterning in

Arabidopsis and, 422–23

1

ICK1 gene plant cell cycle and, 249-50, 255

Ilex aquifolium photosynthesis of overwintering evergreens and, 337

immutans mutant diiron carboxylate proteins and, 505

indeterminate mutant gibberellins and flowering of grasses and cereals, 323-24

Indole acetic acid (IAA) nitric oxide and, 121–22, 127

Inductive signaling transfer cells and, 431–48 Inflorescence development

gibberellins and flowering of grasses and cereals, 307, 312–13

Insect damage functional genomics of P450s and, 642

Insertional mutagenesis single-nucleotide reverse genetics and, 375

Integrative biochemical profiling metabolomics in systems biology and, 669, 680, 682–83

Interfacial membrane binding

diiron carboxylate proteins and, 497-511

International Agricultural Research Centers (IARCs)

history of research, 16-17 Intersystem electron transport

photosynthesis of overwintering evergreens and, 341-42

Invagination transfer cells and, 431–48

IPT gene cytokinin perception and signal transduction, 620

IREG gene

iron transport and signaling in plants, 194

Iron transport and signaling in plants

Aft1 regulon, 186

conclusions, 200-1 dicotyledonous plants,

187–90 Fe³⁺ reductase/Fe²⁺ transporter system, 184–85

graminaceous plants, 190-92

hormones, 200 intracellular iron trafficking, 186

intracellular iron transport for compartmentalization within organelles, 194–96 introduction, 184

iron acquisition by roots, 187-92 iron deficiency response,

200 iron uptake, 184–85 long-distance iron transport

between organs and tissues, 192–94 long-range signaling, 197–200

miscellaneous iron

transport systems, 185 mutants, 198–200 nongraminaceous plants,

187-90 plants, 187-200

posttranscriptional regulation, 197

sensing, 186–200

transcriptional regulation, 196-97

yeast, 184-86

IRT1 gene

iron transport and signaling in plants, 188–89, 192–93, 196–97, 200

Isoamylase starch biosynthesis and, 207, 222-24

Isocyclic ring chlorophyll diiron carboxylate proteins and, 497

ITP gene iron transport and signaling in plants, 193–94

1

JAB1 protein COP9 signalosome and, 167 Jasmonic acid COP9 signalosome and, 173-74

K

K+ transport in higher plants AtPP2CA, 589 beta subunits, 588–89 Ca2+, 590–91 CCC family, 586 cell growth, 594 chronology, 576–77 cloning strategies, 576–77 complexity, 591–92

conclusions, 594

Knockouts

single-nucleotide reverse

genetics and, 375

CPA family, 586 KRP1 gene cyclic nucleotide-gated plant cell cycle and, channels, 585 249-50, 255 cyclic nucleotides. KUP/HAP/KT transporters 590-91 K+ transport in higher dual mechanism, 591-92 plants and, 575, 583-84 14-3-3 proteins, 589 glutamate receptors, 585 L LAB198999 heterotetramerization. 587-88 gibberellins and flowering high-affinity K+ uptake, of grasses and cereals, 592-93 HKT transporters, Larix spp. 584-85 photosynthesis of introduction, 576 overwintering evergreens K+ uptake, 591-93 and, 330 KCO channels, 582-83 Lateral inhibition kinases, 589 epidermal patterning in KUP/HAP/KT Arabidopsis and, 403-24 transporters, 583-84 LCT1 protein LCT1, 585 K+ transport in higher modulation of transcript plants and, 585 levels, 586-87 molecular bases of K+ cryptochrome structure and transport regulation, signal transduction, 469 586-91 epidermal patterning in molecular identity. Arabidopsis and, 421-22 576-86 gibberellins and flowering multigene families, of grasses and cereals, 576-77 307, 310-11 pH, 590-91 photosynthesis of phloem, 593-94 overwintering evergreens and, 329-48 physiology, 591-94 regulatory proteins, LeIRT genes 588-89 iron transport and signaling Shaker channels. in plants, 189 577-79, 581-82 Lemna trisulca voltage gating, 590-91 chloroplast movement and, xylem sap, 593 461-63 **KCO** channels le mutant K+ transport in higher brassinosteroids and, 149 plants and, 575, 582-83 Kinetin cryptochrome structure and history of research, 4 signal transduction, 484

COP9 signalosome and,

174

315, 319, 323 Lhcb gene photosynthesis of overwintering evergreens and, 336 Light brassinosteroids and, 145-46 chloroplast movement and, 465 cryptochrome structure and signal transduction, 469, 471-89 functional genomics of P450s and, 642 photosynthesis of overwintering evergreens and, 329-48 Lignins biotechnology, 535-36 broader definition. 522-23 composition, 520-23 conclusions, 536-37 dehydrogenation, 532-33 functional genomics of P450s and, 629-34 general aspects, 520-22 introduction, 520 monolignol biosynthesis, 524-28, 531-32 nucleation sites, 534-35 perspectives, 536-37 polymerization, 533-35 radical generation/ coupling, 533-34 structure, 520-23 topochemistry, 523-24 transgenic plants, 528-31 variability, 523-24 Lilium spp. brassinosteroids and, 151 transfer cells and, 445 Limit-dextrinases

gibberellins and flowering

of grasses and cereals,

starch biosynthesis and, Linkage disequilibrium animal systems, 364-65 Arabidopsis thaliana, 366-67 current issues, 367-71 dissecting traits, 362-64 effects on, 360-62 genome dissection. 370-71 humans, 364-65 introduction, 358 measurement, 359-60 outcrossing, 368-69 overview, 358-59 plant systems, 365-67 population structure. 367-68 recombination hot spots, 369-70 selfing, 368-69 summary, 371 Zea mays, 365-66 Lipid-binding domains

Lipid-binding domains phospholipid-based signaling and, 265, 268-77 Lipid kinases

phospholipid-based signaling and, 265–92 Liquid chromatography/mass

spectrometry (LC/MS) metabolomics in systems biology and, 669–84

Lithospermum spp. functional genomics of P450s and, 652

lk mutants brassinosteroids and, 143, 150

Local signaling epidermal patterning in Arabidopsis and, 408–10, 414–15, 418–20 Lolium spp.

gibberellins and flowering of grasses and cereals, 307, 309–20, 323–24 history of research, 4–5, 7–11, 14

Long day-responsive cereals gibberellins and flowering of grasses and cereals, 310-13, 321

Long-range signaling iron transport and signaling in plants, 183, 197–200

Lonicera japonica transfer cells and, 435 LRR domain

disease resistance genes and, 30 LUC gene

cytokinin perception and signal transduction, 615, 617 LY83583

nitric oxide and, 122

Lycopersicon spp.
brassinosteroids and, 151
disease resistance genes
and, 33

K⁺ transport in higher plants and, 579

M

Macrosiphum euphorbiae disease resistance genes and, 25

Magnoporthe grisea disease resistance genes and, 25, 28, 36

Mahonia repens photosynthesis of overwintering evergreens and, 337

Malto-oligosaccharides starch biosynthesis and, 207, 216, 225

Malva neglecta
photosynthesis of

overwintering evergreens and, 337, 340, 344

man1 mutant

iron transport and signaling in plants, 199

Mannitol stress

functional genomics of P450s and, 643-44

Marchantia polymorpha brassinosteroids and, 139, 144, 151, 155

Matchmaker model disease resistance genes and, 38-39

Maternal parent apomixis and, 547-67

Mechano-stress-induced movement chloroplast movement and, 456, 462-63

Medicago spp.
metabolomics in systems
biology and, 673
plant cell cycle and, 254
transfer cells and, 443

Meiosis apomixis and, 547-67 Melampsora lini

disease resistance genes and, 25

Meloidogyne spp. disease resistance genes and, 25 transfer cells and, 443

Membrane-binding proteins diiron carboxylate proteins and, 497-511

Mesembryanthemum crystallinum

K⁺ transport in higher plants and, 579-80

Mesotaenium caldariorum chloroplast movement and, 457

Metabolism

brassinosteroids and, 137, 150-55

cytokinin perception and signal transduction, 605-21 functional genomics of P450s and, 629-56 starch biosynthesis and, 207-27

Metabolomics in systems biology

> biological variability, 675-76 causal connectivity, 679-81 conclusions, 683-84 differential metabolomics, 677-79 genotype/phenotype classification, 671-75 integrative biochemical profiling, 680, 682-83 introduction, 670 pattern recognition, 671-75 plant systems, 670-71 snapshot analysis, 677-79 snapshot correlation

networks, 679–81 stochastic noise, 676–77 system modeling, 676–77 technical variability,

675–76

Methenyltetrahydrofolate cryptochrome structure and signal transduction, 471,

474-75, 478

MFT genes

iron transport and signaling in plants, 186

Mg-protoporphyrin IX monomethylester hydroxylase (MME hydroxylase)

diiron carboxylate proteins and, 497, 507-10

Microarrays

functional genomics of P450s and, 629, 638–44 single-nucleotide reverse genetics and, 375

Microfibrils

transfer cells and, 438

Microfilaments

cytoskeleton remodeling for growth and form, 702-8

Microtubules

chloroplast movement and, 456, 463

cytoskeleton remodeling for growth and form, 691, 710-12

Mitochondria

plant peroxiredoxins and, 93-103

Mitogen-activated protein kinases (MAPKs) nitric oxide and, 121-22

Mitosis

plant cell cycle and, 235, 252-53

Mixed allsorts

apomixis and, 554-55 Monolignol biosynthesis lignin biosynthesis and,

519, 524-28, 531-32 Moonlighting enzymes functional genomics of P450s and, 635

Mougeotia scalaris chloroplast movement and, 457, 462

MPN motifs

COP9 signalosome and, 168-69

Mugineic acids

iron transport and signaling in plants, 190-92

Multiprotein recognition complexes disease resistance genes and, 33-35

MYB gene

epidermal patterning in Arabidopsis and, 403, 416-17 gibberellins and flowering of grasses and cereals, 315

Myosin

cytoskeleton remodeling for growth and form, 707-8

N

Naat genes

iron transport and signaling in plants, 190-91

NBS region

disease resistance genes and, 30-31

Near isogenic lines (NILs) linkage disequilibrium and, 362

NEDD8 protein

COP9 signalosome and, 172, 175–76

Neurospora crassa cryptochrome structure

and signal transduction, 476

K⁺ transport in higher plants and, 583

nitric oxide and, 117

Nicotiana spp. brassinosteroids and, 151 COP9 signalosome and,

> disease resistance genes and, 43, 46

history of research, 8 nitric oxide and, 118 plant cell cycle and, 238,

255
Nicotianamine synthase
iron transport and signalin

iron transport and signaling in plants, 190-91 Nitric oxide (NO)

abscisic acid, 122-24 animals, 111-18

antioxidant properties, 114-15 auxins, 121-22 chemical richness, 112-15 conclusions, 126-28 cross-talk, 121-26 cytokinins, 124-26 ethylene, 126 future research, 126-28 generation, 115-16 gibberellins, 124-26 history, 111-12 hormones, 121-26 introduction, 110-11 measurement, 115-16 molecular targets, 112-14 nitrate reductase, 109, 116-19 nitric oxide synthase, 116-18 nitrogen fertilization, 119-20 pharmacological effects, 120 physiological roles, 120 phytochrome pathways, 124-26 plants, 111-12, 115-26 processing pathways, 120 - 21pro-oxidant properties, 114-15 regulated endogenous production, 127-28 rooting, 121-22 senescence, 126 signaling pathways, 120-21 structure/function comparison, 116-18 synchronizing chemical messenger, 127 transduction pathways, 120-21 water deficit, 122-24 Nocardia spp. nitric oxide and, 117

Nongraminaceous plants iron transport and signaling in plants, 187-90 Nonheme iron proteins diiron carboxylate proteins and, 497-511 Northern Hemisphere photosynthesis of overwintering evergreens and, 329-48 nph mutants chloroplast movement and, NPL1 gene chloroplast movement and, 458-59 NRAMP genes iron transport and signaling in plants, 185-86, 189-90, 193-96 NUC-1 gene transfer cells and, 447 Nucellar tissue apomixis and, 550 Nuclear proteins cryptochrome structure and signal transduction, 469, 471-89

Nuclear speckles cryptochrome structure and signal transduction, 487 Nucleation sites lignin biosynthesis and, 519, 534–35

Nutrient distribution iron transport and signaling in plants, 183–201 transfer cells and, 431–48

O

Oligonucleotide arrays functional genomics of P450s and, 629, 638–44 "Omic" technologies metabolomics in systems biology and, 669–84 "On and off" switch

protein phosphatases and, 63-83 Opuntia stricta photosynthesis of overwintering evergreens and, 337 Organogenesis plant cell cycle and, 235 transfer cells and, 441-42 Ornithopus sativus brassinosteroids and, 151 Orvza sativa brassinosteroids and, 151 cryptochrome structure and signal transduction, 474-75 gibberellins and flowering of grasses and cereals, 322, 324 K+ transport in higher plants and, 580 starch biosynthesis and, 214-15 transfer cells and, 434 OsDwarf gene brassinosteroids and. 143-44 OsGA3ox genes

OsGA3ox genes gibberellins and flowering of grasses and cereals, 314 Osmotic stress

phospholipid-based signaling and, 280, 286–87

Ostreococcus taurii starch biosynthesis and, 211

Out-of-Africa model linkage disequilibrium and, 365

Outcrossing linkage disequilibrium and, 357, 364, 368–69

Overexpressing constructs functional genomics of P450s and, 650-51 Ovule

apomixis and, 547-67

Oxidases

diiron carboxylate proteins and, 497, 501-6 gibberellins and flowering of grasses and cereals.

307, 310, 313–14, 318, 324

Oxidation

brassinosteroids and, 137-41

P

Paclobutrazol

brassinosteroids and, 146 gibberellins and flowering of grasses and cereals, 320

pag mutant

plant peroxiredoxins and, 103

Panicum spp.

apomixis and, 555, 561-62 gibberellins and flowering of grasses and cereals, 320

Parthenogenesis apomixis and, 547-67

Paspalum spp.

apomixis and, 562, 565 gibberellins and flowering of grasses and cereals, 309

Patatin

phospholipid-based signaling and, 289-90

Pathogen effector proteins disease resistance genes and, 23-49

Pattern formation epidermal patterning in Arabidopsis and, 403-24

Pattern recognition metabolomics in systems biology and, 671-75

Pavement cells

epidermal patterning in Arabidopsis and, 421–22 PCI motifs

COP9 signalosome and, 168-69

Pennisetum spp.

apomixis and, 554-65 Perennial grasses

gibberellins and flowering of grasses and cereals, 320

Peronospora parasitica disease resistance genes and, 25, 43-44

Peroxides plant peroxiredox

plant peroxiredoxins and, 93-103

Peroxiredoxins (Prx) algae, 99–101 antioxidant defense, 101–3 1-Cys peroxiredoxin, 94–95

2-Cys peroxiredoxin, 95-96, 102 detoxification of peroxides,

environmental modulation, 99–100

family, 94–97, 102 introduction, 94 peroxiredoxin Q, 96–97

photosynthesis, 101–2 plants, 99–101 redox signaling, 100–1

signaling, 102–3 subcellular localization of prx, 99

thylakoids, 102 tissue-specific expression of prx, 99

of prx, 99 type II peroxiredoxin, 96 water-water cycle, 102

PH domain phospholipid-based signaling and, 270

Phaeocerus laevis transfer cells and, 434 Pharbitis nil

diiron carboxylate proteins and, 507, 509

gibberellins and flowering of grasses and cereals, 323

history of research, 10 Phaseolus vulgaris

brassinosteroids and, 144, 150-51

cytoskeleton remodeling for growth and form, 695, 705

transfer cells and, 434

Phenotypic analysis functional genomics of

P450s and, 646-51 metabolomics in systems biology and, 671-75

single-nucleotide reverse genetics and, 389

Phloem

K⁺ transport in higher plants and, 593-94

Phospholipid-based signaling C2-domain, 271 cloning, 277, 282, 285,

288-90 DAG, 281-83

dehydration, 286-87 ethylene, 287

expression, 277, 285, 288-90

FYVE domain, 269–70 hyperosmotic stress, 291

introduction, 266 IP₃, 280-81

IP₆, 280–81

lipid-binding domains, 268–77

osmotic stress, 280-87 overview, 266-68

PA-kinase, 281–83

patatin, 290 pathogen interaction, 288, 290

perspectives, 291-92

PH domain, 270 cryptochrome structure and plant peroxiredoxins and, phosphoinositide kinases, signal transduction, 469, 93, 101-2 483-84 starch biosynthesis and. phospholipase A2, 288-90 gibberellins and flowering 207 phospholipase C, 277-80 of grasses and cereals, Photosystems I and II 307-24 phospholipase D, 283-88 chloroplast movement and. PI 3-kinase, 271-73 history of research, 1, PI3P, 271-73 4-10, 17 photosynthesis of PI3P5-kinase, 276-77 **Photoreceptors** overwintering evergreens PI(3,5)P2, 276-77 chloroplast movement and, and, 329, 341-42, 345-46 PI 4-kinase, 273 **Phototropins** PI4P. 273 cryptochrome structure and chloroplast movement and, PI4P5-kinase, 274-76 signal transduction, 469. 456, 457-61 PI(4,5)P2, 274-76 471-89 cryptochrome structure and PI5P, 273-74 **Photostasis** signal transduction, 482 plant defense, 279-80 photosynthesis of PHR domain purification, 288-90 overwintering evergreens cryptochrome structure and and, 334-37 PX domain, 271 signal transduction, seed germination, 278-79 Photosynthesis 471-80 stomatal opening, 278-79 chloroplast movement and, phr mutants wounding, 286, 291 456-66 cryptochrome structure and Phosphorelay overwintering evergreens signal transduction, 472 cytokinin perception and and phy mutants signal transduction, 605, antenna, 342-44 brassinosteroids and, 155 607 autumn, 337, 339 chloroplast movement and, Phosphorylation chlororespiration, 346 cryptochrome structure and cold acclimation, cryptochrome structure and signal transduction, 469, 332-37 signal transduction, 487-89 combined effects of light 483-84, 488 disease resistance genes and frost, 339-41 Physarum polycephalum and, 23, 46-47 conclusions, 346-48 nitric oxide and, 117 protein phosphatases and, energy conundrum, 331 Physcomytrella spp. 63 - 83frost hardening, 332-35 chloroplast movement and, Phosphotransfer intersystem electron 457, 462-64 cytokinin perception and cryptochrome structure and transport, 341-42 signal transduction. signal transduction, introduction, 330-31 614-15 photostasis, 334-37 474-76 phot mutants photosystem I, 341-46 single-nucleotide reverse chloroplast movement and, photosystem II, 345 genetics and, 378 seasonal variations. 459-63, 465 **Phytochromes** cryptochrome structure and 337-39 chloroplast movement and, signal transduction, 456, 460-61 spring, 339 482-83 summer, 339 COP9 signalosome and, Photomorphogenesis sustained winter 177 COP9 signalosome and, dissipation of absorbed cryptochrome structure and 169-72 light, 342-46 signal transduction, 469, winter, 337-39 Photoperiodism 486

cytokinin perception and iron transport and signaling signal transduction, 611-12, 619 nitric oxide and, 124-26 Phytophthora infestans disease resistance genes and, 25 Phytosiderophores iron transport and signaling in plants, 190 **Phytotronics** PNZIP gene history of research, 1, 3-7 Picea spp. photosynthesis of overwintering evergreens and, 330 Pichia spp. diiron carboxylate proteins

and, 501 functional genomics of P450s and, 652, 654

PI gene COP9 signalosome and, 174

Pigments functional genomics of P450s and, 629, 634

PIN-FORMED mutant COP9 signalosome and. 170

PINOID mutant COP9 signalosome and, 170

Pinus spp. photosynthesis of overwintering evergreens and, 330, 332-33, 337, 344

Pisum sativum brassinosteroids and, 151 chloroplast movement and,

nitric oxide and, 124 starch biosynthesis and, 214-15

transfer cells and, 434 Plantago lanceolata

in plants, 198 Plasma membrane cytoskeleton remodeling for growth and form, 691. 698, 703-4, 712 transfer cells and, 431-48

Plastid terminal oxidase diiron carboxylate proteins and, 497, 505-6

diiron carboxylate proteins and, 507-9 Poa pratensis

gibberellins and flowering of grasses and cereals. 320 history of research, 10, 12

Pogonatum aloides transfer cells and, 434 Polarized growth

cytoskeleton remodeling for growth and form, 691, 709

Pollen tubes K+ transport in higher plants and, 575-94

Polymerization lignin biosynthesis and, 519, 533-35

Pooideae gibberellins and flowering of grasses and cereals, 320

Population structure linkage disequilibrium and, 357, 367-68

Populus trichocarpa plant peroxiredoxins and,

Porphyra spp. diiron carboxylate proteins and, 507 plant peroxiredoxins and,

Posttranscriptional regulation iron transport and signaling

in plants, 183, 197 Potato virus X disease resistance genes and, 25 Potentilla spp. apomixis and, 556 Preamylopectin starch biosynthesis and, 223

Prepattern signaling epidermal patterning in Arabidopsis and, 415

Priming starch biosynthesis and, 225-26

Profilins cytoskeleton remodeling for growth and form, 704-5

Promoter:reporter fusions functional genomics of P450s and, 645 Proteasome

COP9 signalosome and, 165, 168-71, 175, 177 Protein degradation

COP9 signalosome and, 165-78 cryptochrome structure and signal transduction, 480 disease resistance genes and, 23, 45-46 starch biosynthesis and, 224-25

Protein kinases K+ transport in higher plants and, 589 protein phosphatases and, 63-83

Protein localization disease resistance genes and, 23, 36 functional genomics of P450s and, 645-46

Protein phosphatases future perspectives, 83 introduction, 64

protein tyrosine phosphatases function, 78-83 general properties, 76-78 nomenclature, 76-78 serine/threonine phosphatases function, 72 general properties, 65-67 nomenclature, 64-65 plants, 67-70 PP1/2A, 72-74 PP2C, 74-76 regulation, 70-72 Protein-protein interactions disease resistance genes and, 23-49 Protein tyrosine phosphatases protein phosphatases and, 63-83 **Proteomics** disease resistance genes and, 23 metabolomics in systems biology and, 669-84 prx genes plant peroxiredoxins and, 94-103 psaAB gene photosynthesis of overwintering evergreens and, 336 PsbA gene photosynthesis of overwintering evergreens and, 336 Pseudomonas spp. diiron carboxylate proteins and, 507 disease resistance genes and, 25, 41, 43-44 functional genomics of P450s and, 639 phospholipid-based signaling and, 279

photosynthesis of overwintering evergreens and, 337 PSST gene cytokinin perception and signal transduction, 614 pt/amp1 mutant plant cell cycle and, 248 Pterins cryptochrome structure and signal transduction, 471 Pteris cretica chloroplast movement and, 464 Puccinia spp. disease resistance genes and, 25-26 Pullulanases starch biosynthesis and, 222-23 PX domain

Q

linkage disequilibrium and, 357, 371 Quenching sustained photosynthesis of overwintering evergreens and, 329

phospholipid-based

signaling and, 271

Quantitative proteomics

metabolomics in systems

biology and, 669-84

Quantitative trait loci (QTLs)

Quinols diiron carboxylate proteins and, 497-511

R

Radical generation/coupling lignin biosynthesis and, 533–34

rag l gene single-nucleotide reverse genetics and, 385-86 Ralstonia solanacearum disease resistance genes and, 26 RAN1 gene iron transport and signaling in plants, 195 Ranunculus spp. apomixis and, 555, 562 RARI protein COP9 signalosome and. 174-75 RBR genes plant cell cycle and, 250 RCN genes gibberellins and flowering of grasses and cereals, protein phosphatases and, 74 Reaction center photosynthesis of overwintering evergreens and, 335, 338, 341 Receiver domains cytokinin perception and signal transduction. 616-17 Receptor-ligand model disease resistance genes and, 38 Recognition complexes disease resistance genes and, 33-40 Recombination hot spots linkage disequilibrium and, 357, 369-70 Redox homeostasis regulation nitric oxide and, 109, 126 Redox signaling iron transport and signaling

in plants, 183

Regulatory signaling

Resistance genes

93-103

plant peroxiredoxins and,

transfer cells and, 444-45

disease resistance genes

plant peroxiredoxins and,

iron transport and signaling

in plants, 193-94

Ricinus communis

RITI gene

and, 23-49 iron transport and signaling Saccharum spp. Respiration in plants, 189 linkage disequilibrium and, diiron carboxylate proteins Root hairs and, 497-511 epidermal patterning in nitric oxide and, 118 plant peroxiredoxins and, Arabidopsis and, 403, Salmonella typhimurium 93-103 412-16, 422-23 plant peroxiredoxins and, Response regulators Roots cytokinin perception and iron transport and signaling Salt stress signal transduction, 605, in plants, 187-92 functional genomics of 612-19 K+ transport in higher P450s and, 642, 644 Retinoblastoma protein plants and, 575-94 Samanea saman plant cell cycle and, 250 nitric oxide and, 121-22 K+ transport in higher Reverse genetics **ROP GTPases** plants and, 579, 587 chloroplast movement and, cytoskeleton remodeling Sauromatum guttatum 456-66 for growth and form, 691, diiron carboxylate proteins single-nucleotide reverse 700, 708-9 and, 501, 503 genetics and, 375-98 Rottboellia exultata sax1 mutant Reversible conversion history of research, 10 brassinosteroids and, 142 brassinosteroids and, 144 RPM1 gene SCF E3 ligases RFL gene linkage disequilibrium and, COP9 signalosome and, gibberellins and flowering 367 175, 177 of grasses and cereals, RUB1/NEDD8 protein SCF ubiquitin ligases 319 COP9 signalosome and, COP9 signalosome and, 165, 172, 175-76 rga mutant 172 - 75gibberellins and flowering Rubrivivax gelatinosus Schizosaccharomyces pombe of grasses and cereals, diiron carboxylate proteins COP9 signalosome and, 324 and, 507-8 166 R genes rug5 mutant cytokinin perception and COP9 signalosome and, starch biosynthesis and, signal transduction, 609 175 217 phospholipid-based disease resistance genes signaling and, 275-76, and, 23-49 S 280 Rhizobium spp. Saccharomyces cerevisiae Schwanniomyces occidentalis phospholipid-based COP9 signalosome and, K⁺ transport in higher signaling and, 279 plants and, 583 transfer cells and, 443 cryptochrome structure and Scoring SNPs Rht genes signal transduction, 476 single-nucleotide reverse gibberellins and flowering cytokinin perception and genetics and, 394-96 of grasses and cereals, signal transduction, 607, Seasonal variations 323-24 609 photosynthesis of Riccia fluitans functional genomics of overwintering evergreens

P450s and, 651, 654

phospholipid-based

iron transport and signaling

in plants, 184-86, 193,

signaling and, 276, 285

and, 337-39

Second messengers

phospholipid-based

Secondary wall ingrowths

signaling and, 265-92

transfer cells and, 431-48

Sedum lineare plant peroxiredoxins and, Seeds apomixis and, 547-67 phospholipid-based signaling and, 278-79 Selfing linkage disequilibrium and, 357, 364, 368-69 Senescence nitric oxide and, 126 Serine/threonine phosphatases protein phosphatases and, 63-83 Severing cytoskeleton remodeling for growth and form, 706-7 Sexuality apomixis and, 547-67 SGT1 protein COP9 signalosome and. 174-75 Shaker channels K+ transport in higher plants and, 575, 577-79, Shoot apex gibberellins and flowering of grasses and cereals, 307, 311-15, 324 Short day-responsive cereals gibberellins and flowering of grasses and cereals. 321-23 shrunken-2 mutant starch biosynthesis and,

212-22

471-89

COP9 signalosome and,

cryptochrome structure and signal transduction, 469,

cytokinin perception and

Signaling

signal transduction. 605-21 cytoskeleton remodeling for growth and form, 691. 698-701 disease resistance genes and, 23-49 epidermal patterning in Arabidopsis and, 403-24 functional genomics of P450s and, 629, 633 gibberellins and flowering of grasses and cereals, 307, 315 iron transport and signaling in plants, 183-201 nitric oxide and, 109-28 phospholipid-based signaling and, 265-92 plant peroxiredoxins and, 93-103 protein phosphatases and, transfer cells and, 431-48 Sildenafil nitric oxide and, 126 Silencing functional genomics of P450s and, 647, 650 Sinapis alba cryptochrome structure and signal transduction, 476 Single nucleotide polymorphisms (SNPs) linkage disequilibrium and, 358-62, 364, 366, 368-70 Single-nucleotide mutations plant functional genomics allelic series, 392-94 Arabidopsis TILLING project, 396-97 background mutations, 389-91

future research, 397-98

genome-wide

mutagenesis and

screening, 378-80 genotyping, 389, 391-92 heteroduplex analysis, 383-85 high-throughput service, 396-97 high-throughput TILLING, 386-88 introduction, 376-77 perspectives, 397-98 phenotype, 389 reverse genetic strategies, 377-80 scoring SNPs, 394-96 SNP discovery methods. 385-86 targeting specific loci, 377-78 target mutations, 389-91 technologies for detecting single-nucleotide differences, 383-94 TILLING mutagenesis. 380-98 Sink organ size/strength history of research, 12-13 Sitosterol brassinosteroids and, 146 sln1 mutant cytokinin perception and signal transduction, 609 Sl-prx Q gene plant peroxiredoxins and, Small-molecular-weight metabolites metabolomics in systems biology and, 669-84 SMF genes iron transport and signaling in plants, 185-86, 188 smt mutants brassinosteroids and, 148, 156 Snapshot analysis metabolomics in systems

biology and, 677-81 Soils iron transport and signaling in plants, 183 nitric oxide and, 109. 119-20, 127 Solanum tuberosum K+ transport in higher plants and, 579 phospholipid-based signaling and, 280 starch biosynthesis and, 214-15 Soluble starch synthases starch biosynthesis and, 213-14, 217-19 Solute transporters transfer cells and, 431-48 Somatic embryogenesis apomixis and, 558-59 Sorghum bicolor gibberellins and flowering of grasses and cereals. 322-23 transfer cells and, 434 SPIKE1 gene cytoskeleton remodeling for growth and form, 708-9 Spinacea oleracea nitric oxide and, 118 STA genes iron transport and signaling in plants, 195 starch biosynthesis and, 218 Starch granule biogenesis ADPglucose, 212-13 **ADPglucose** pyrophosphorylase, 212-13 amylose, 214-19 branching enzymes, 219-22

debranching enzymes,

degradation, 224-25

222-24

future research, 226-27 GBSSI, 214-17 α-1.4 glucanotransferases, 224-25 glycogen metabolism in bacteria, 209-11 glycogen synthesis, 225-26 granule-bound starch synthases, 213-14 introduction, 208-9 priming mechanisms, 225-26 soluble starch synthases. 213-14, 217-19 starch synthases, 214 summary, 226-27 stel mutant brassinosteroids and, 149 Stem elongation cryptochrome structure and signal transduction, gibberellins and flowering of grasses and cereals, 307, 309, 313-19, 323 Steroid sulfotransferases brassinosteroids and, 155 Sterols brassinosteroids and, 137, 146-50 Stigmasterol

brassinosteroids and, 146

disease resistance genes

metabolomics in systems

epidermal patterning in

phospholipid-based

Storage polysaccharides

207-27

Arabidopsis and, 403-24

signaling and, 278-79

starch biosynthesis and,

STK domain

and, 32

Stochastic noise

Stomata

cryptochrome structure and signal transduction, 482 Subcellular localization COP9 signalosome and, sugary mutants starch biosynthesis and. 218, 223 Survival chloroplast movement and, 456-66 Synchronizing chemical messenger nitric oxide and, 109, 127 Synchronous cell systems plant cell cycle and. 237-38 Synechocystis sp. cryptochrome structure and signal transduction, 471, 472-73, 476 biology and, 669, 676-77 diiron carboxylate proteins and, 506, 509-10 plant peroxiredoxins and, 101 - 2starch biosynthesis and, 211 Systems biology metabolomics and, 669-84

Stress response

93-103

Stress signaling

363, 366

sul mutant

222

SUB1 gene

456, 462-63

chloroplast movement and.

functional genomics of

plant peroxiredoxins and,

transfer cells and, 442-43

signaling and, 265-92

starch biosynthesis and,

linkage disequilibrium and,

P450s and, 642-45

phospholipid-based

320

Trichomes

epidermal patterning in

T plant peroxiredoxins and, Transdetermination Target mutations epidermal patterning in chloroplast movement and, **TILLING** mutagenesis Arabidopsis and, 410-11 456-66 single-nucleotide reverse Transfer cells single-nucleotide reverse genetics and, 375, 379-98 cell differentiation, 441-43 genetics and, 377-78, Time-of-flight (TOF) cellulose microfibrils, 438 389-91 technology composition, 438 metabolomics in systems Taxus spp. functionality, 446-47 functional genomics of biology and, 674-75, 678 future research, 448 P450s and, 653 hypothetical model. TIR domain tbr mutant disease resistance genes 443-47 brassinosteroids and, and, 31 identity genes, 447 T-loops 143 inductive signals, 444-45 T-DNA/transposon knockout plant cell cycle and, 240 introduction, 432-34 analysis Tobacco mosaic virus model systems, 434-35 functional genomics of COP9 signalosome and. organ development, P450s and, 646-49 175 441-42 Teasterone disease resistance genes patterns of deposition, brassinosteroids and, 144 and, 25-26 435-38 Temperature Tomato spotted wilt virus polarity, 445 photosynthesis of disease resistance genes regulatory signals, 444-45 overwintering evergreens and, 25 stress-induced cell and, 329-48 ton2 mutant differentiation, 442-43 protein phosphatases and, Teopod gene transport function, 439-41 gibberellins and flowering 74 wall ingrowth/plasma of grasses and cereals, Topochemistry membrane complex, 324 lignin biosynthesis and, 435-41, 445-46 Terminal oxidases 519, 523-24 Transgenes diiron carboxylate proteins Tpl gene COP9 signalosome and, and, 497, 505-6 gibberellins and flowering TFL gene of grasses and cereals, lignin biosynthesis and, gibberellins and flowering 324 519, 528-31 of grasses and cereals, Tradescantia spp. single-nucleotide reverse chloroplast movement and, genetics and, 375 Themeda australis Transport history of research, 9 plant cell cycle and, 249, iron transport and signaling Thermosynechococcus 253 in plants, 183-201 elongatus Trafficking K+ transport in higher diiron carboxylate proteins iron transport and signaling plants and, 575-94 and, 509 transfer cells and, 431-48 in plants, 186 Thiol-disulfide reactions Transcriptional regulation Triazoles plant peroxiredoxins and, cytokinin perception and brassinosteroids and, 146 93-103 signal transduction. gibberellins and flowering Thioredoxins 615-16 of grasses and cereals,

iron transport and signaling

in plants, 183, 196-97

plant cell cycle and, 235

plant peroxiredoxins and,

93-103

Thylakoids

Arabidopsis and, 403, 405-12, 416, 421-22

Triglochin spp.

functional genomics of P450s and, 653

Trinexepac ethyl (TNE) gibberellins and flowering of grasses and cereals, 318

Tripsacum spp. apomixis and, 561-62

Triticum aestivum

K⁺ transport in higher plants and, 579–80 photosynthesis of overwintering evergreens and, 332–33 starch biosynthesis and, 214–15

transfer cells and, 434

Trypanosoma cruzi
nitric oxide and, 117

Turnip crinkle virus disease resistance genes and, 25, 35

Typhasterol brassinosteroids and, 144

U

174

ubiF mutant diiron carboxylate proteins and, 507

Ubiquinones diiron carboxylate proteins and, 497–511

Ubiquitin COP9 signalosome and, 165, 170–77

UFO gene COP9 signalosome and,

Ultraviolet (UV) protectants functional genomics of P450s and, 629, 634

Ulva lactuca chloroplast movement and, 465

Uncoupling apomixis and, 551 Uniconazole brassinosteroids and, 146 Upstream regulation cytoskeleton remodeling for growth and form, 708–9

V

Verticillium alboatrum disease resistance genes and, 26 Vibrio cholerae plant peroxiredoxins and, 96

Vicia faba
K+ transport in higher
plants and, 579, 594
nitric oxide and, 124
phospholipid-based
signaling and, 280
transfer cells and, 434,
436–37, 445

Vicia sativa functional genomics of P450s and, 630, 653

Vigna spp. brassinosteroids and, 151 starch biosynthesis and, 214-15

Villin
cytoskeleton remodeling
for growth and form.

for growth and form, 706–7 Vinca minor

photosynthesis of overwintering evergreens and, 337, 340

Virulence proteins disease resistance genes and, 28

Viruses COP9 signalosome and, 175

disease resistance genes and, 23-49 Vitis vinifera
K+ transport in higher plants and, 579
Voltage gating
K+ transport in higher plants and, 590–91
VSP gene
COP9 signalosome and.

173 W

Warm-climate cereals gibberellins and flowering of grasses and cereals, 321-23

Water deficit nitric oxide and, 122–24 Water-soluble

polysaccharides starch biosynthesis and, 222, 224

Water-water cycle photosynthetic plant peroxiredoxins and, 102

WD repeats epidermal patterning in Arabidopsis and, 403-24

WEE1 kinases plant cell cycle and, 239, 255

White light chloroplast movement and, 465 functional genomics of

P450s and, 642

Winter

photosynthesis of overwintering evergreens and, 329–48

wol mutant cytokinin perception and signal transduction, 610

Wolbachia spp. apomixis and, 566

Wounding stress functional genomics of

P450s and, 642, 644-45 phospholipid-based signaling and, 286, 291 WUSCHEL gene plant cell cycle and, 250

X

Xanthium spp. history of research, 4 Xanthomonas spp. disease resistance genes and, 25

Xanthophylls photosynthesis of overwintering evergreens and, 329-48

Xenopus laevis cryptochrome structure and signal transduction, 472 K+ transport in higher plants and, 577, 587, plant cell cycle and, 245 protein phosphatases and,

Xylem sap K+ transport in higher plants and, 575-94

Y

73

vl gene linkage disequilibrium and, 366

Yeast

COP9 signalosome and, 165-66, 174 cryptochrome structure and signal transduction, 476 cytokinin perception and signal transduction, 607, diiron carboxylate proteins and, 501 functional genomics of P450s and, 651-52, 654 iron transport and signaling in plants, 184-86, 193, 195, 197 K+ transport in higher plants and, 583 phospholipid-based signaling and, 275-76,

starch biosynthesis and, 224 yellow stripe mutants iron transport and signaling in plants, 190-93

280, 285

Yield potential history of research, 13-14, 18

YSL gene iron transport and signaling in plants, 193-94, 199 Yucca glauca

photosynthesis of

overwintering evergreens and, 337

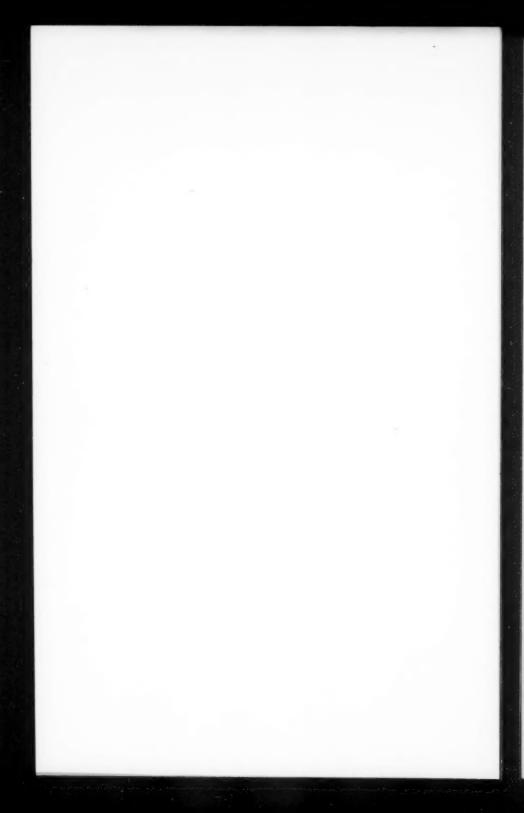
Z

Zea mays

cytokinin perception and signal transduction, 613 gibberellins and flowering of grasses and cereals. 321-23 K+ transport in higher plants and, 579 linkage disequilibrium and, 357, 364-66, 368, 370-71 nitric oxide and, 118 plant cell cycle and, 244 starch biosynthesis and, 214-15 transfer cells and, 434, 447 Zinnia elegans transfer cells and, 444, 448 Zostera capensis transfer cells and, 443 ZRT1 gene iron transport and signaling in plants, 197

ZTL/LKP1/ADO1 gene cryptochrome structure and signal transduction. 486-87

zwichel mutant cytoskeleton remodeling for growth and form, 710





CONTENTS

Frontispiece—Lloyd T. Evans	xii
CONJECTURES, REFUTATIONS, AND EXTRAPOLATIONS, Lloyd T. Evans	1
UNDERSTANDING THE FUNCTIONS OF PLANT DISEASE RESISTANCE	
PROTEINS, Gregory B. Martin, Adam J. Bogdanove, and Guido Sessa	23
PROTEIN PHOSPHATASES IN PLANTS, Sheng Luan	63
PLANT PEROXIREDOXINS, Karl-Josef Dietz	93
NITRIC OXIDE: THE VERSATILITY OF AN EXTENSIVE SIGNAL MOLECULE, Lorenzo Lamattina, Carlos García-Mata,	
Magdalena Graziano, and Gabriela Pagnussat	109
BIOSYNTHESIS AND METABOLISM OF BRASSINOSTEROIDS,	137
Shozo Fujioka and Takao Yokota	13/
THE COP9 SIGNALOSOME: REGULATING PLANT DEVELOPMENT THROUGH THE CONTROL OF PROTEOLYSIS, Giovanna Serino	
and Xing-Wang Deng	165
IRON TRANSPORT AND SIGNALING IN PLANTS, Catherine Curie	183
and Jean-François Briat	183
FROM BACTERIAL GLYCOGEN TO STARCH: UNDERSTANDING THE BIOGENESIS OF THE PLANT STARCH GRANULE, Steven G. Ball	
and Matthew K. Morell	207
THE PLANT CELL CYCLE, Walter Dewitte and James A.H. Murray	235
PHOSPHOLIPID-BASED SIGNALING IN PLANTS, Harold J.G. Meijer and Teun Munnik	265
GIBBERELLINS AND FLOWERING OF GRASSES AND CEREALS: PRIZING	
OPEN THE LID OF THE "FLORIGEN" BLACK BOX, Rod W. King and Lloyd T. Evans	307
PHOTOSYNTHESIS OF OVERWINTERING EVERGREEN PLANTS, Gunnar Öquist and Norman P.A. Huner	329
STRUCTURE OF LINKAGE DISEQUILIBRIUM IN PLANTS,	357
Sherry A. Flint-Garcia, Jeffry M. Thornsberry, and Edward S. Buckler IV	33/
SINGLE-NUCLEOTIDE MUTATIONS FOR PLANT FUNCTIONAL GENOMICS, Steven Henikoff and Luca Comai	375

HOW DO CELLS KNOW WHAT THEY WANT TO BE WHEN THEY GROW UP? LESSONS FROM EPIDERMAL PATTERNING IN ARABIDOPSIS, John C. Larkin, Matt L. Brown, and John Schiefelbein	403
TRANSFER CELLS: CELLS SPECIALIZED FOR A SPECIAL PURPOSE, Christina E. Offler, David W. McCurdy, John W. Patrick, and Mark J. Talbot	431
CHLOROPLAST MOVEMENT, Masamitsu Wada, Takatoshi Kagawa, and Yoshikatsu Sato	455
CRYPTOCHROME STRUCTURE AND SIGNAL TRANSDUCTION, Chentao Lin and Dror Shalitin	469
MEMBRANE-BOUND DIIRON CARBOXYLATE PROTEINS, Deborah A. Berthold and Pål Stenmark	497
LIGNIN BIOSYNTHESIS, Wout Boerjan, John Ralph, and Marie Baucher	519
APOMIXIS: A DEVELOPMENTAL PERSPECTIVE, Anna M. Koltunow and Ueli Grossniklaus	547
MOLECULAR MECHANISMS AND REGULATION OF K ⁺ TRANSPORT IN HIGHER PLANTS, Anne-Aliénor Véry and Hervé Sentenac	575
PERCEPTION AND SIGNAL TRANSDUCTION OF CYTOKININS, Tatsuo Kakimoto	605
FUNCTIONAL GENOMICS OF P450s, Mary A. Schuler and Daniele Werck-Reichhart	629
METABOLOMICS IN SYSTEMS BIOLOGY, Wolfram Weckwerth	669
REMODELING THE CYTOSKELTON FOR GROWTH AND FORM: AN OVERVIEW WITH SOME NEW VIEWS, Geoffrey O. Wasteneys	
and Moira E. Galway	691
INDEXES	
Subject Index	723
Cumulative Index of Contributing Authors, Volumes 44-54	753
Cumulative Index of Chapter Titles, Volumes 44-54	758

ERRATA

An online log of corrections to *Annual Review of Plant Biology* chapters (if any, 1997 to the present) may be found at http://plant.annualreviews.org/

